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Review paper on waste management

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Abstract

Effective waste management is essential for ensuring environmental sustainability and protecting public health, and urban planning. This review examines current practices, challenges, and innovations in waste management, with a particular focus on Maharashtra, India. It analyzes global and local strategies, providing a comprehensive understanding of waste management and suggesting pathways for improvement. The paper highlights the importance of waste segregation, recycling, composting, and waste-to-energy initiatives, alongside the need for robust policies and public participation.

Keywords: Waste management, segregation, environment

Introduction

Rapid urbanization and population growth have resulted in a generation of waste day by day rising. Effective waste management is important for mitigating environmental pollution, protecting resources, and public health. This paper reviews the current state of waste management, focusing on innovative approaches and policy frameworks, particularly in Maharashtra, India.

Current Practices in Waste Management

1. Segregation and Collection of Waste

- Waste segregation at source is key principle of efficient waste management, involving the separation of waste into categories such as dry and wet waste.
- Collection systems vary widely, from door-to-door collection services to community bins, and play a crucial part in maintaining urban cleanliness and hygiene.

2. Recycling and Resource Recovery

- Recycling transforms waste materials into new products, conserving natural resources and reducing the amount of waste sent to landfills.
- Resource recovery facilities extract valuable materials and energy from waste, contributing to a circular economy.

3. Composting

- Composting organic waste reduces landfill volumes and produces compost, a valuable soil amendment.
- Initiatives like Harit Maha City Compost in Maharashtra promote urban composting, turning organic waste into compost for agricultural and gardening use.

4. Waste-to-Energy (WTE)

- WTE technologies convert waste materials into energy, reducing dependency on fossil fuels and minimizing landfill use.
- Maharashtra has been exploring various WTE projects to enhance its waste management infrastructure and address the growing waste problem.

Challenges in Waste Management

1. Insufficient Infrastructure

Several areas lack the necessary infrastructure for effective waste collection, segregation, and processing. This inadequacy hampers the effective management of waste and leads to environmental and health issues.

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2. Public Awareness and Participation

Limited public understanding and involvement in waste management practices hinder the effectiveness of these systems. Educating communities about the importance of waste segregation and recycling is crucial.

3. Policy and Regulatory Issues

Inconsistent policies and regulatory frameworks can impede the implementation of comprehensive waste management strategies. Clear, enforceable policies are essential for effective waste management.

4. Financial Constraints

Limited funding for waste management projects restricts the development and maintenance of necessary infrastructure. Investment in waste management is essential for sustainable development.

Innovations and Best Practices

1. Smart Waste Management Systems

The integration of technology, such as IoT and AI, into waste management can improve collection routes, monitor bin levels, and reduce operational costs. These technologies advance efficiency and minimize the environmental footprint of waste management operations.

2. Extended Producer Responsibility (EPR)

Policies that enforce manufacturer accountability throughout the lifecycle of their products promote the design of more sustainable products and higher recycling rates. This approach reduces the burden on municipal waste management systems.

3. Community-led Initiatives

Grassroots movements and community-led programs can significantly improve waste segregation and recycling practices at the local level. Community engagement is key to successful waste management.

4. Circular Economy Approaches

Adopting circular economy principles, where waste is seen as a resource, can lead to more sustainable waste management practices. This approach emphasizes the reuse, recycling, and recovery of waste materials.

Case Study: Waste Management in Maharashtra

Maharashtra has implemented several initiatives to improve waste management. The Swachh Maharashtra Mission (Urban) aligns with the national Swachh Bharat Mission, focusing on urban cleanliness and effective waste management. The Maharashtra Plastic and Thermocol Products Notification, 2018, bans single-use plastics to reduce environmental pollution. The Maharashtra Pollution Control Board (MPCB) regulates pollution and promotes waste segregation, recycling, and treatment facilities. Additionally, the state has launched public awareness campaigns and community participation programs to foster sustainable waste management practices.

Swachh Maharashtra Mission (Urban)

The Swachh Maharashtra Mission (Urban) aims to create clean and hygienic urban environments. The mission focuses on solid waste management, eliminating open defecation, and promoting cleanliness. It emphasizes the importance of waste segregation at the source, efficient collection and transportation, and scientific disposal of waste. The mission also encourages public participation and community involvement.

Maharashtra Plastic and Thermocol Products Notification, 2018

To combat plastic pollution, Maharashtra implemented a ban on single-use plastics and thermocol products. This policy aims to reduce the environmental effect of plastic waste and promote the use of eco-friendly alternatives. The notification includes measures to safeguard proper recycling to final disposal of plastic waste, thereby reducing the burden on landfills and protecting the environment.

Maharashtra Pollution Control Board (MPCB)

The MPCB plays a vital role in regulating pollution and promoting waste management in the state. It oversees the implementation of waste management policies, monitors compliance, and facilitates the development of waste treatment and recycling facilities. The board also conducts awareness campaigns to educate the public about sustainable waste management practices.

Public Awareness and Community Participation Programs

Public awareness and community participation are vital for the success of waste management initiatives. Maharashtra has launched several campaigns to educate citizens about the importance of waste segregation, recycling, and composting. These programs encourage community involvement and foster a sense of responsibility towards the environment.

Harit Maha City Compost Initiative

The Harit Maha City Compost initiative focuses on converting organic waste into compost, promoting urban agriculture and gardening. By encouraging the separation of organic waste at the source and supporting composting facilities, this initiative helps decrease the volume of waste sent to landfills and provides a valuable resource for improving soil health and fertility.

Waste-to-Energy Projects

Maharashtra is exploring various waste-to-energy projects to convert waste materials into renewable energy. These projects help reduce landfill use, generate energy, and decrease dependency on fossil fuels. By integrating waste-to-energy technologies into its waste management infrastructure, Maharashtra aims to create a more sustainable and efficient system.

Zero Waste Initiatives

Some cities and regions within Maharashtra have adopted zero waste goals to minimize landfill use. These initiatives promote recycling, composting, and waste reduction practices to achieve a zero-waste target. By fostering a circular economy, zero waste initiatives contribute to environmental sustainability and resource conservation.

Conclusion

Effective waste management is crucial for environmental sustainability and public health. While challenges remain, innovative approaches and comprehensive policy frameworks can significantly improve waste management systems. Maharashtra's initiatives, such as the Swachh Maharashtra Mission, plastic ban, MPCB regulations, and composting and waste-to-energy projects, provide a model for other regions to enhance their waste management practices. Continued efforts in public education, infrastructure development, and policy implementation are essential for achieving long-term sustainability goals.

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